Technical Lessons Learned - FMTT Demo: Neutron Multiplicity Counter

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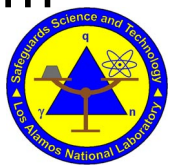
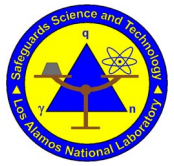
Lessons from FMTT Demo

- Overview
- Repairs, Modifications and System Failures
  - Neutron Multiplicity Counter
  - Portable Shift Register
- Optimized System
  - Optimized Neutron Multiplicity Counter
  - Software Fixes
  - Integrated Neutron & Gamma-Ray System

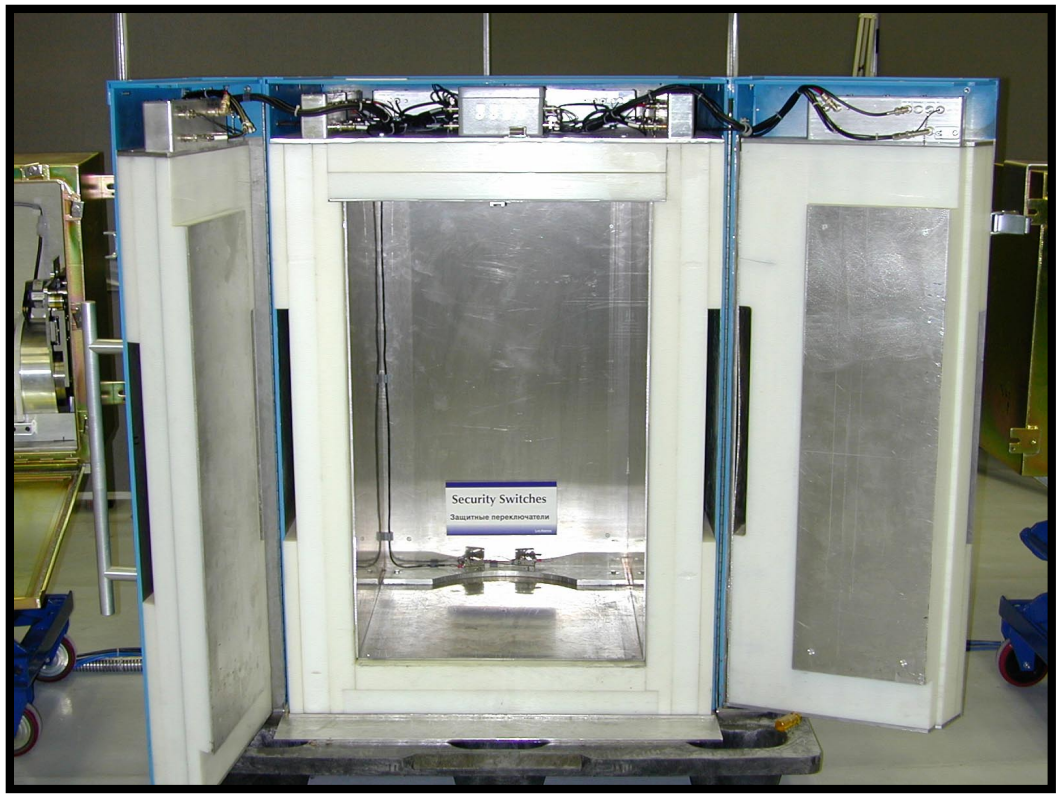


Attributes: Neutron Measurements

Attribute	Method	Specific Mechanisms
Pu Mass	NMC & Pu600	—**^{240}Pu-effective + isotopics**
Absence of Oxide	NMC & Pu900	—**Alpha > 0.5 and 870.8 keV line present**
Symmetry	NMC & Symmetry Analyzer	—**eight detector banks confirm symmetry**



Neutron Multiplicity Counter



- Commercial coincidence counter designed for shipper/ receiver measurements.
- Adequate system for proof-of-principle.
- A fully optimized counter would require shorter count times and produce better multiplicity results.

Portable Shift Register (PSR-B)

NMC & PSR-B Repairs

- Neutron Coincidence/Multiplicity Counters are Very Robust

  Replaced one Amptek and desiccant after 10+ years in storage.

- Portable Shift Register - B

  Shipped with incorrect resistance chain in High Voltage Power Supply.

NMC Modifications

- Active Splitter

  Necessary to drive longer cable length.

- Derandomizer

  Reduction in overall deadtime of the system.

- Symmetry Analyzer

  System was modified to give 8 outputs for symmetry Scalars.

NMC & PSR-B Failures

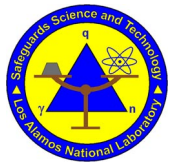
- NMC - Amptek board failure.

  Quickly replaced with spare.

- PSR - B

  Inherent failure mode from serial port noise in startup.

  Fixed procedurally by bringing entire system up at the same time.



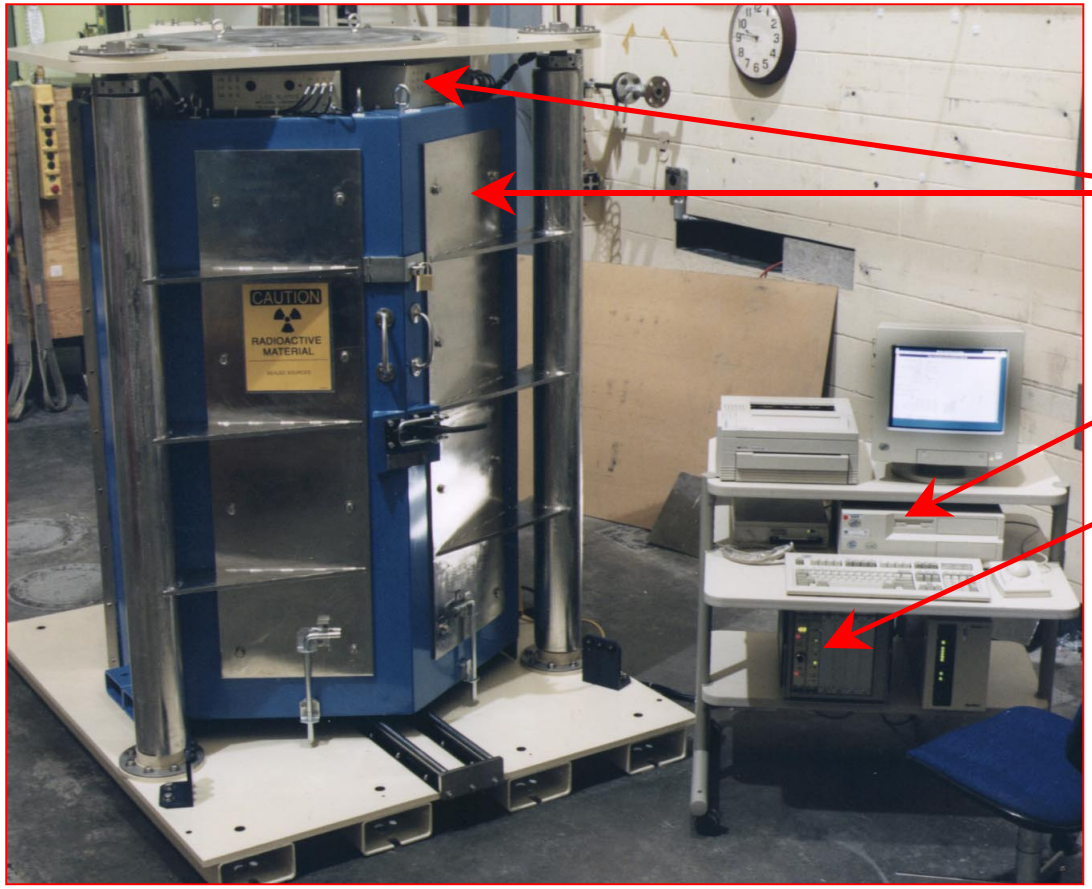
System Optimization

- Optimized NMC

  Higher efficiency and Intelligent Shift Register would result in reduced count time.

  Able to spend more time on different measurements (i.e. authentication….) or shortened day in High-bay.

Neutron Multiplicity Counter: A Fully Optimized System



- Detector head with junction box
- Computer
- Multiplicity shift register and power supplies

System Optimization

- Software improvements

  HV ramp-up delay.

  Improve error handling capabilities.

  Translate output into Russian and English.

  Remove debugging comments.

  Change to sample statistics from theoretical.

System Optimization

- Co-location of neutron and gamma-ray system.

  Reduction in overall count time and improved accuracy.

- Allow for troubleshooting and integration into AMS/IB.
- Improve power shutdown so that “spikes” do not kill sensitive systems, yet protect information.